life-histories exhibit a most surprising lack of agreement. In fact, the early stages in the life of *Alpheus heterochelis* in the Bahama Islands differ much less from those of *Alpheus minor* or *Alpheus Normani* than they do from those of the North Carolina *Alpheus heterochelis*; and, according to Packard, the Key West *heterochelis* presents still another life-history.

In the summer of 1881 I received the 'American Naturalist' with Packard's very brief abstract of his observations at Key West upon the development of *Alpheus heterochelis*, and read with great surprise his statement that this species has no metamorphosis, since, while still inside the egg, it has all the essential characteristics of the adult. As I had under my microscope at Beaufort on the very day when I read his account a newly hatched larva of the same species and was engaged in making drawings to illustrate the metamorphosis of which he denies the existence, and as my experience in the study of other Crustacea had taught me that all the larvæ of a species at the same age are apparently facsimiles of each other down to the smallest hair, Packard's account seemed absolutely incredible, and I hastily decided that, inasmuch as it was without illustrations and was written from notes made many years before, it involved some serious error and was unworthy of acceptance. This hasty verdict I now believe to have been unjust, since my wider acquaintance with the genus has brought to my notice other instances of equally great diversity between the larvæ of different specimens of a single species.

The phenomenon is, however, a highly remarkable one and worthy the most thorough examination, for it is a most surprising departure from one of the established laws of embryology—the law that the embryonic and larval stages of animals best exhibit their fundamental affinities and general resemblances, while their specific characteristics and individual peculiarities make their appearance later.—*Am. Journ. Sci.*, Feb. 1893, pp. 166, 167.

Absorption in the Actiniæ *and the Origin of the Mesenterial Filaments.* By Victor Willem, Assistant in Zoology at the University of Ghent.

If albumen stained with carmine is administered to specimens of *Actinia* or *Sagartia* it is found that at the end of a few hours particles of carmine are present in the cells of the lining of the enteric cavity. Properly speaking this absorption does not take place in the enteroids, as is stated by Krukenberg * and Metschnikoff †, but at first and chiefly in the region of the radial partitions which adjoins these filaments, a region where the epithelium forms a thickening parallel with the edge of the septum ‡; the grains of

* Krukenberg, "Ueber den Verdauungsmodus der Actinien," Vergl.-phys. Studien an der Küste der Adria, 1 Abth., 1880.

† Metschnikoff, "Ueber die intracellulare Verdauung bei Cœlenteraten," Zool. Anz. 1880, p. 261.

‡ *Vide* Hertwig, "Die Actinien," Jenaische Zeitschrift, 1879, Taf. xxi. fig. 13.

carmine are again met with in the cells of the grooves which separate either the lateral ciliated bands from the median band which is provided with nematocysts, or the lateral bands from one another *.

If nutriment tinctured with carmine is supplied in great abundance, not only does the red coloration become more intense in the regions which have just been indicated, but we also find grains of carmine in large numbers in the cells of the whole endodermic lining. In *Sagartia* again, contrary to the assertion of Metschnikoff, these may be easily observed in the acontia, throughout the entire zone which is devoid of nematocysts and gland-cells †.

Moreover, identical results are obtained by using mussel's liver; the yellowish-brown coloration of the fatty globules contained in the cells of this organ enables us to recognize the same progression in the absorption of these droplets. The examination of sections of *Actiniæ* which have been fed abundantly upon the fat-body of caterpillars shows, in the cells of the entire endodermic lining and in those of the regions of the mesenterial filaments or of the acontia which I have indicated above ‡, the presence of numerous fatty droplets, which are often of enormous size relatively to the dimensions of the elements which contain them.

In the numerous fresh or prepared specimens which I have examined I have never seen a particle of carmine or a fatty globule in a cell of one of the three swellings which enter into the composition of a typical mesenterial filament.

Absorption therefore belongs in itself to the whole of the endodermic lining, and if (as, for instance, when the animals were supplied with nutriment stained with carmine) it appears to be more evident in certain parts of the enteroids and in their neighbourhood, this is due to two causes: in the first place to the fact that the zones in question, being closer to the spot § at which the disaggregation of the ingested matters takes place, capture the grains of carmine as soon as they are set at liberty by the dissolution of their substratum; those only which penetrate into the radial divisions are absorbed by the general lining. In the second place it is due to the existence along the enteroids of a thickening in which the more elevated cells accumulate more of the carmine particles.

The localization of the absorbent cells brings out an important point in the disposition of the different tissues in the *Actiniæ*, which is in relation to their nutrition and the absence of an actual circulatory system. All the regions of the body, of however little extent, include cells in which there takes place an intra-cellular digestion and the elaboration of the assimilable substances which are destined for the elements in the immediate neighbourhood: the outer wall, including the tentacles and the stomodæum itself, is clothed with an endodermic lining; the swellings of the enteroids are separated by bands of absorbent cells, while the acontia exhibit on one of their

* *Ibid.* Taf. xxi. figs. 10 and 14. † *Ibid.* Taf. xvi. fig. 11.

‡ These are shown in the Hertwigs' figures as constituted by a granular epithelium.

§ The central region of the general cavity.

faces a zone which may be termed the nutritive zone of the acontium; in the immediate neighbourhood of the mesenterial filaments —at the spot where the median swelling alone persists—the epithelium of the septa exhibits a special development, which seems to me to be in direct relation to the nutrition of these organs of secretion.

These physiological facts appear to me to contribute towards clearing up the origin of the convoluted filaments in ontogeny. Heider *, relying on the identity of their histological structure, admitted the ectodermic origin of the enteroids in *Cerianthus*, and E. B. Wilson † considered it to be very probable that the lateral lobes are the homologues of the ectodermic bands of the Alcyonaria, while in his opinion the central lobe is of an endodermic nature. A. Andres ‡ thought that he had succeeded in deriving certain filaments of the Actiniaria from ectodermic proliferations of the stomodæum. But it seems to follow, from certain observations of H. V. Wilson §, that this ectodermic origin ought to be attributed not only to the lateral lobes, but also to the median one, at the very least in the case of the primary mesenteries.

However it may be with regard to supposing, as appears to me to be very probable, that the three lobes composing a typical filament are of an ectodermic nature, it is not less probable that, relying on the identity in histological structure and physiological function, we ought to consider as **endodermic the regions of the filaments which separate the lobes from one another and the nutritive zone of the acontia.**—*Zoologischer Anzeiger*, xvi. Jahrg., no. 409 (January 9, 1893), pp. 10–12.

On Phagocytosis observed, in the living Animal, in the Gills of Lamellibranch Mollusca‖. By M. de Bruyne.

In a communication of Nov. 3, 1891 ('Annales de la Faculté de Médecine de Gand'), I mentioned incidentally some phenomena of phagocytosis which had been observed in the normal ciliated epithelium of the gills and mantle of Lamellibranch Mollusks; these observations related exclusively to fixed preparations. Since then I have studied the phenomenon in the living animal, by operating upon four very common forms—*Mytilus*, *Unio*, and *Anodonta*, which are very suitable for this kind of observation, and *Ostrea*, which is much less so, probably on account of the thickness of its gills.

If a fragment of gill be removed from a freshly opened specimen of one of these animals (*Mytilus* by preference), and examined under the microscope, the observer is struck by the clearness with

* V. Heider, "*Cerianthus membranaceus*," Sitzgsber. Akad. Wiss. Wien, Bd. lxxix. (1879).

† E. B. Wilson, "The Mesenterial Filaments of the Alcyonaria," Mittheil. zool. Stat. Neapel, Bd. v. (1884).

‡ A. Andres, quoted in the foregoing paper.

§ H. V. Wilson, "The Development of *Manicina areolata*," Journal of Morphology, 1889.

‖ The investigations were conducted at the Laboratory of Normal Histology of the University of Ghent.